

CIAOGCR  
The Chili-Peru Border Region

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1 of 1

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## *The Chile-Peru Border Region*

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October 1975

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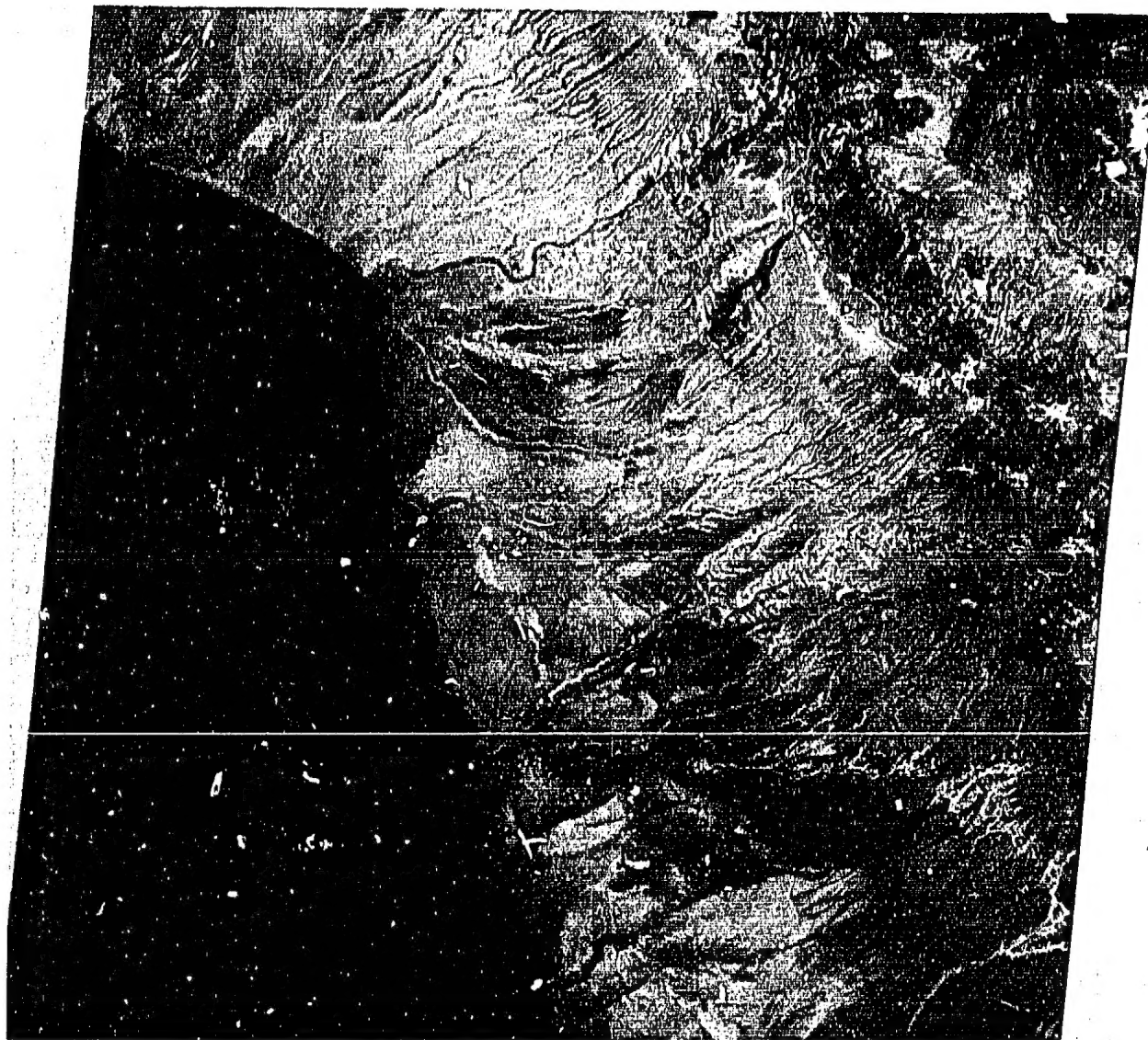
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## THE CHILE-PERU BORDER REGION



Border region from vicinity of La Yarada, Peru to the vicinity of Pisagua, Chile (compare with map). Note deep canyons, particularly Rio Lluta in the north and Rio Camarones in the south, also, long sweep of beach fronting the Pampa de la Yarada, and steep bluffs south of Arica. (UNC)

i  
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SECRET

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## CONTENTS

	<i>Page</i>
Physical Geography .....	1
Terrain .....	1
Vegetation .....	3
Weather and Climate .....	3
Transportation .....	4
Roads .....	4
Railroads .....	5
Airfields .....	5
Ports .....	6
Pipeline .....	8
Population and Settlements .....	8
Economic Activities .....	9
Mining .....	9
Agriculture .....	11
Fishing .....	11
Electric Power .....	12
Annex A: Landing Beaches .....	13
Annex B: POL Storage at Selected Ports .....	15

## MAPS

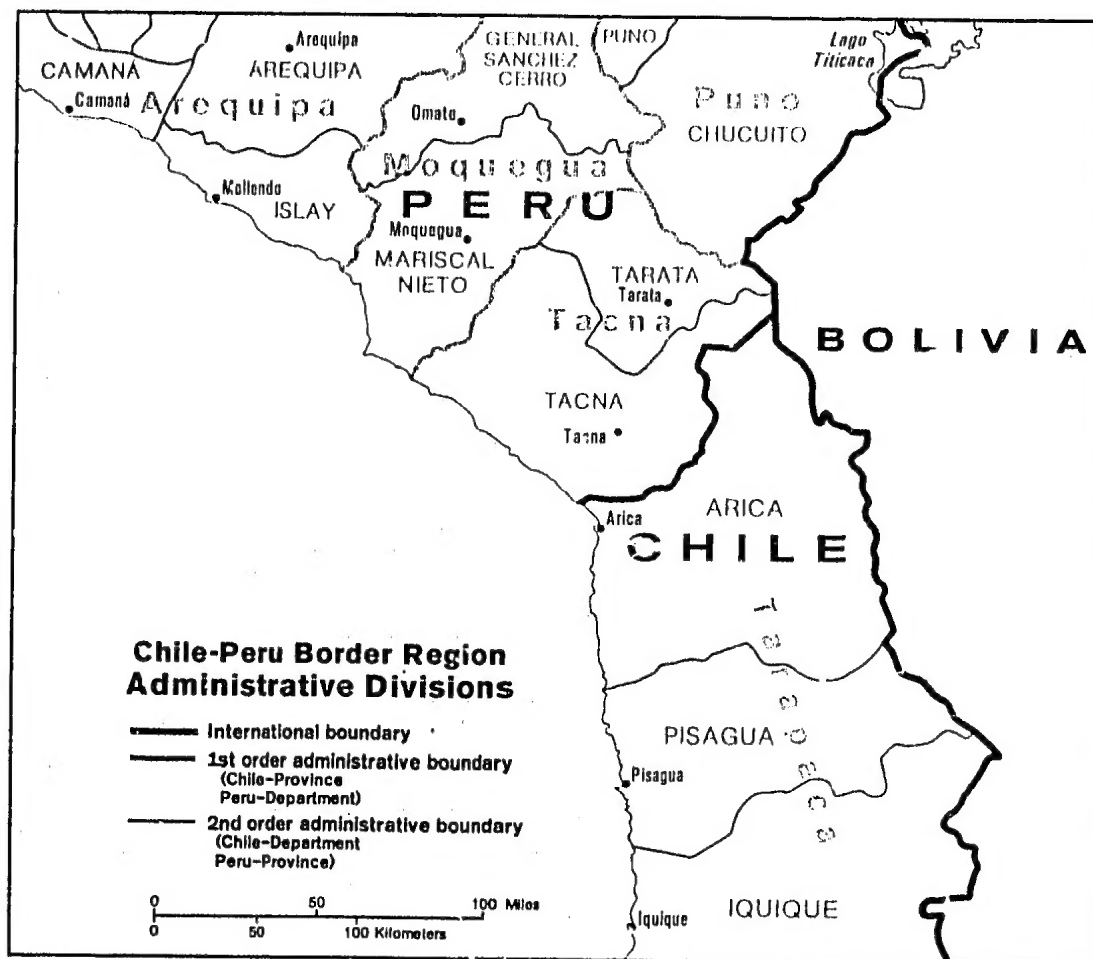
	<i>Page</i>
Chile-Peru Border Region Administrative Divisions .....	iv
Chile-Peru Border Region .....	<i>fold-out</i> 15

iii

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NOFORN-NOCONTRACT-PROPIN



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iv

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SECRET

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## THE CHILE-PERU BORDER REGION

Despite official pronouncements of mutual respect and peaceful intentions, armed conflict between Chile and Peru is a distinct possibility in the next few years. An Interagency Memorandum issued in late 1974 noted "the potent mixture of old antagonisms, mutual fears, and the actions and reactions of the arms build-up that could cause events to get out of control and produce results which neither party contemplates."\* Since publication of that memorandum Soviet-made tanks have been identified in southern Peru, and although Velasco of Peru was deposed in August 1975 by the more moderate General Morales Bermudez, the potential for armed conflict remains. This paper describes the logical arena for the opening of any new Chile-Peru war—the arid border region between the two countries.\*\* (S)

Military activities in the Chile-Peru border region would be adversely affected by high altitudes, aridity, and rugged terrain; and large-scale operations would be difficult to sustain logistically because of the inadequacy of the transportation facilities. Hence, the incentive to strike first and

to move rapidly would be strong for either side that considered war desirable or unavoidable. Successful attacks against a relatively few airfield, port, and highway targets would sharply reduce the logistical and defensive capabilities of the country that suffered them. Militating against achieving surprise in a large-scale ground operation is the sparsity of natural cover in the region; an undetected massing of troops and equipment near the border would be almost impossible. Both Chile and Peru would stand to suffer significant losses of economic resources if forced to relinquish sizable tracts of frontier territory. (C)

### PHYSICAL GEOGRAPHY

#### Terrain

Most of the Chile-Peru border region is mountainous, more than 95 percent of it higher than 600 meters above sea level. Even near the coast rounded hills and mountains surround high plains. Except for one broad expanse of lowland north of Arica, areas under 600 meters are restricted to narrow strips skirting the shore or extending up the lower ends of stream valleys. Elevations higher than 3,600 meters are reached only 50 kilometers from the sea in most places, and farther inland some of the higher peaks rise above 5,500 meters. Volcan Tacora, an enormous volcano dominating the highland portion of the Chile-Peru border, rises to an elevation of almost 6,000 meters.\*

A west-to-east cross-section of the region near the latitude of Arica reveals a forbidding coast with rocky cliffs facing the sea, then an increasingly steep rise to the fringes of the lofty Andean plateau

\*Peru and Chile: Reassessment of the Potential for Conflict, DCI/NIO 2684-74. (Secret/NoFORN/Controlled Dissem)

\*\*In this survey the "Chile-Peru border region" includes not only the immediate frontier zone but also the entire departments of Tacna and Moquegua and portions of Arequipa and Puno, Peru, and the northern part of the province of Tarapaca, Chile. Parts of adjacent Bolivian territory are also considered but in less detail. In Peru and Bolivia, a department is a first order administrative division which is broken down into provinces; in Chile the province is the first order administrative unit, and it is divided into smaller units called departments. Third order administrative units have different designations in each country. These relationships may be shown as follows:

Peru	Bolivia	Chile
Department	Department	Province
Province	Province	Department
District	Canton	Comuna

(Chile is in the process of forming new administrative divisions which are to be called regions; Tarapaca Province will become Region I.)

\*Unless otherwise indicated, all paragraphs are unclassified.

NOTE: This paper was produced by the Office of Geographic and Cartographic Research. Comments or questions may be directed to [REDACTED] Code 143, Extension 3128.

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known as the Altiplano. The western margin of the Altiplano, which corresponds to the Bolivia-Chile border, is marked by a chain of high volcanic mountains. North and south of Arica high coastal ranges modify the east-west profiles (e.g., see fold-out map, p. 15).



High cliffs facing the ocean near the mouth of the Quebrada de Vitor, Chile. Note the potential landing place at the mouth of the river. (UNC)

The rugged terrain makes movement of wheeled or tracked vehicles impracticable throughout much of the border region. Scattered plains (pampas) on or near the coast provide the best drop zones and helicopter landing sites in the region as well as favorable conditions for the movement of military vehicles. But most of the plains are high, isolated, and small, hedged in by mountains and hills or dissected by steep-walled stream valleys.

The largest and only low plain in the immediate vicinity of the border is the Pampa de la Yarada, which extends northward from Arica into Peru and is bordered along the Pacific by a sandy beach. It forms a lowland wedge projecting inland for about 25 kilometers—to within 8 kilometers of Taena. The Chileans are reported to have heavily mined their part of the Pampa de la Yarada and its beach. (S)

Another fairly extensive flat area lies a short distance northwest of the Pampa de la Yarada on the other side of the Rio Sama, in Peru. The central part of this area comprises a number of plains divided by stream valleys and collectively called the Pampas del Eslagonal; the whole area is 15 to 25 kilometers across, averages about 300 meters in elevation, and is separated from the sea by 8 to 15 kilometers of coastal hills. Two smaller plains lie farther to the northwest—the Pampa de la Joya, separated from the coast by high mountains, and a very small plain

in the vicinity of the coastal resort of Mejia that extends a short distance up the valley of the Rio Tambo. Shifting sand dunes 3 meters tall migrate inland across sections of the Pampa de la Joya creating road maintenance problems and obstacles to movement across country.

The Pampa de Camarones, a high plain in Chile between the Quebrada de Vitor and the Rio Camarones, is cut off from the ocean by a narrow belt of coastal mountains. Farther to the south, from about the latitude of Pisagua and continuing out of the study area, is a series of high plains—collectively known as the Pampa de Tamarugal—separated from each other by dry stream valleys reaching inland toward the Andes. Numerous salt flats spread across shallow basins on these plains. The surfaces of the salt flats appear smooth from a distance, but closer inspection often reveals a rugged microrelief of pits, cracks, and clumps of solidified salts.



Salt flats and bunch grass on plain inland from Matarani, Peru. (C)

In both countries great canyons called *quebradas* cut east to west across the region from the mountains to the sea. Some of the larger *quebradas* on the Chilean side are more than 750 meters deep and 3 kilometers wide. The Chileans are relying on these formidable gorges as defensive barriers should Peru invade with tanks, and in places they have artificially steepened the canyon sides. (S)

There are few sites suitable for amphibious landings. Along much of the coast, cliffs rise abruptly from the sea and, even in many places where landing is possible, steep hills and mountains impede egress inland. There are, however, some stretches of the coast where amphibious operations would be

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feasible. In addition to the beach that fronts the Pampa de la Yarada, a number of other beaches in the border region might afford good sites for landings. In Peru, a beach stretches between Mollendo and the bathing resort of Mejia, and another shorter one is located at the mouth of the Rio Locumba. In Chile, three small concave beaches are clustered near Iquique, and potential landing sites are located at the mouths of the Quebrada Vitor and the Rio Camarones. Annex A gives further details on these and other beaches and potential landing sites in the border region. (C)



Volcan Tacora, Chile near the Peruvian border. (C)

### Vegetation

Natural vegetation throughout most of this generally arid region is scanty. It varies from practically none in the deserts and dry salt flats to bunch grass and low scrub on the western slopes of mountains exposed to mist and occasional showers and along the valleys with intermittent streams. A few *quebradas* and oases with perennial water supplies support small farms and orchards. Willow trees fringe the margins of some of the larger streams such as the Rio Lluta. Scattered scrub and cactus grow at elevations as high as 3,600 meters on the western slopes of the mountains. Even above that altitude, some areas of grass and low bushes are found. Yareta, a woody, mosslike plant, grows on rocky outcrops at elevations over 3,000 meters, but it no longer covers extensive areas; much of it has been chopped away for firewood. The general sparsity of vegetation means that military units operating in the area would have to rely for concealment on terrain features and such uncertainties as fog and cloud cover.

### Weather and Climate

The heart of the Atacama, the world's driest desert, lies only a short distance to the south, and climatic conditions almost as arid and severe extend throughout much of the border region. The sun-parched zones immediately behind the coastal mountains receive rain only at intervals of many years.

Rainfall is scant throughout the region, but other aspects of the climate vary markedly. High temperatures are common along the coast, with only small annual and diurnal differences. The highlands farther inland are characterized by large annual and diurnal temperature ranges, and the loftier mountains are frequently quite cold; some of the higher peaks along the Bolivian border are perpetually snow clad. Much of the coast is humid, cloudy, and foggy; the zones farther inland have low humidity, are nearly cloudless, and are often subject to blowing dust or sand in the afternoons. Sea breezes are the most important winds affecting the region.

Where there are coastal mountains and hills, moisture-laden winds from the sea are forced to rise, creating cloud banks and occasionally producing rain on the seaward slopes. The rain that does fall is usually in the form of a very light drizzle, little more than a mist. This phenomenon, known locally as the *garua*, occurs principally in the winter—June, July, and August.

With the considerable differences in the height and configuration of the coastal ranges, however, there are corresponding differences in climatic conditions. The comparatively open coast from Arica northward to Mollendo has practically no rainfall and little fog; north and south of this stretch,



Bathing beach at Mollendo, Peru. (UNC)

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where the coastal mountains are more prominent, early morning fog shrouds the slopes daily, and practically every year has at least a small amount of rain.

Except for the frequent low ceilings and early morning fog along sections of the coast, flying conditions are generally good throughout most of the region. In some of the loftier parts of the highlands the rarefied atmosphere does make long runways necessary for airplanes and adversely affects helicopter performance. The weather generally does not prevent amphibious operations in the region during any season, although heavy surf can be a deterrent in some places; it frequently precludes loading and unloading of ships during the afternoons in the winter and spring (June–November) at unprotected anchorages. Heat, lack of water, and blowing sand in the coastal deserts would put a severe strain on troops and equipment engaged in military ground operations; inland, the wide diurnal fluctuations in temperature and the rarefied atmosphere at higher altitudes would sharply reduce the effectiveness of men and equipment. (C)

## TRANSPORTATION

### Roads

The Pan-American Highway is the only major road linking Peru and Chile; it traverses the study area from north to south and provides access to the capitals of both countries. The highway could form a principal axis for attacks in either direction since it follows the best route for ground movement and connects the most likely military objectives. It could also serve as an important supply line to the border region from both sides.



Pan-American Highway passing through rugged terrain south of Arequipa, Peru. (C)

From Lima to Arequipa most of the highway is asphalt surfaced and in good condition, but numerous deep valleys necessitate long steep descents and ascents, and there are many sharp turns, tunnels, and stretches of treacherously narrow roadway. Between Arequipa and Arica the highway's surface is partly asphalt, partly concrete, and in good condition even where it traverses rugged terrain. The segment from Tacna to Arica passes through the barren Pampa de la Yarada paralleling the Tacna-Arica railroad; about 5 kilometers north of Arica it crosses a 75-meter bridge over the Rio Lluta. From Arica south the highway has an asphalt or concrete surface in fair to good condition.



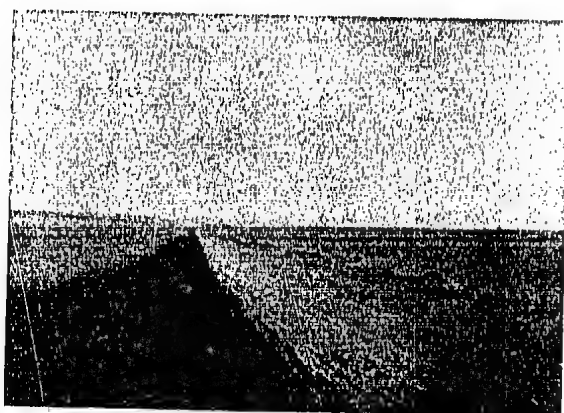
Road linking the port of Matarani, Peru to the Pan-American Highway. (C)

Transverse roads connect the Pan-American Highway with the littoral and with the interior highlands. In Peru the more important extend from the Pan-American Highway to the seaports of Mollendo and Matarani, to the port of Puno on Lake Titicaca (outside the study area), to the port of Ilo, to the Toquepala mine, and to the coast at La Yarada. Similarly, in Chile significant transverse roads connect the Pan-American Highway with the coastal town of Vitor, the ports of Pisagua and Iquique, and various highland communities and mines. A few roads and trails extend all the way to the Bolivian border. One route, utilizing segments of roads in the Rio Lluta and Quebrada de Carones valleys, will when completed form the only paved highway connecting Arica to Bolivia. Asphalt surfacing on this route now extends eastward at least to the vicinity of Zapahuira.

Except for the Pan-American Highway and roads leading from it to Matarani, Ilo, La Yarada, and Iquique, the greater part of the sparse road net-

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work serving the border region is unpaved and poorly maintained. Under the sustained movement of military vehicles and supplies many unpaved sections would soon become impassable, and even paved roads would deteriorate rapidly under heavy loads and tank treads.



Pan-American Highway crossing the Pampa de la Yarada south of Tacna, Peru. (OUO)

#### Railroads

Railroads extend inland from the ports of Matarani, Mollendo, and Ilo in Peru, and from the ports of Arica and Iquique in Chile. The railroad from Mollendo runs along the coast to Mejia and then swings inland to Arequipa. It continues, outside the study area, to Juliaca which is connected to Cuzco and to Puno on Lake Titicaca.

An industrial rail line originating at the copper smelter in Fundicion extends to the port of Ilo and then to the huge open pit copper mine at Toquepala; it is largely used for the movement of minerals and in other operations supporting the mine. Another industrial line now under construction will link Ilo to a new copper mine at Cuajone, 25 kilometers to the northwest of Toquepala. This railroad will pass through a number of tunnels, including one about 15 kilometers long, which will be the longest railroad tunnel in South America. All of the Peruvian lines are single track, except for a short stretch of double-track line near Matarani, and all are standard gage.

The Arica-Tacna railroad, a standard-gage line owned and operated by the Peruvian Government, is the only railroad that crosses the Chile-Peru

border. It is only 63 kilometers long and is not tied to the principal rail networks of either country. A fair number of local merchants and businessmen, tourists, and other passengers shuttle back and forth on this line, but its cargo traffic is not large.

The other and more important railroad originating in Arica is the meter-gage line to La Paz, which parallels the Chile-Peru border situated 10 kilometers to the northwest. Built by the Chilean Government under terms of a 1904 treaty with Bolivia, the railroad serves as one of landlocked Bolivia's major outlets to the sea, and its entire traffic and operations are Bolivian oriented. The line reaches a maximum grade of 6 percent on a rack-rail section that climbs the steep slopes midway between Arica and the Bolivian border.

The only other operating railroad in the border region is the main trunk route extending southward from Iquique. Outside the area this meter-gage single-track line joins a broad-gage line to Santiago at La Calera, where there are facilities for trans-loading and for interchanging running gear. The northern portion of the line is important for the movement of nitrates to Iquique for export. Many additional miles of track that formerly served in the nitrate mining activities of northern Chile have been abandoned.

#### Airfields

The region contains numerous airfields and their number and quality are being upgraded on both sides of the border. The most important military airfield on the Peruvian side is Mariano Melgar, a Peruvian Air Force base forming part of the La Joya military complex. It has the longest paved runway, 4,000 meters (13,150 feet), in Peru. The best Peruvian civil airfield in the region is Rodriguez Ballon Chachani, which serves Arequipa. Its high elevation, 2,581 meters (8,469 feet), has precluded its use by large or heavily loaded aircraft, but the proposed extension of its longest runway from 2,300 meters (7,546 feet) to about 3,000 meters (10,000 feet), scheduled for the first half of 1975, should significantly increase its capabilities. (S)

Other Peruvian airfields with runways 600 meters (2,000 feet) or longer located within the study area include: Camana, Ilo, Mollendo, Moquegua, Tacna, San Isidro, and Santa Rosa. The last two, not shown on the map, are located 37 kilometers west-south-

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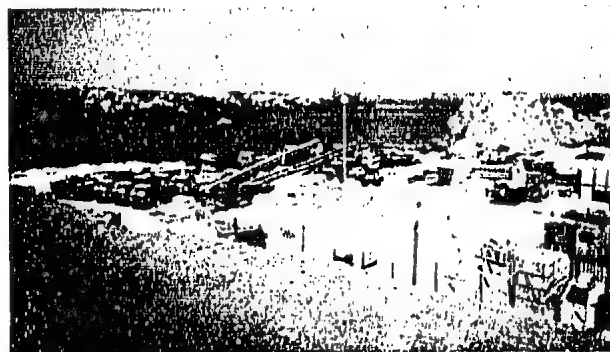
west of Arequipa and 16 kilometers west of Mazo Cruz (50 kilometers northwest of the Bolivian border) respectively. Ilo and Moquegua are known to be used to some extent by the Peruvian Air Force. The airfield at Taena has scheduled commercial airline service, is a port of entry for air traffic from Chile and Bolivia, and serves as an alternate for the airfield at Arequipa. Small airfields with runways shorter than 600 meters (2,000 feet) serve the Toquepala and Cuajone copper mines. Many new airstrips are being built in southern Peru in 1975. In the department of Arequipa alone, 39 emergency landing fields are scheduled for completion by the end of the year; these strips will supplement 21 others that were constructed in the department in 1974.

The best airfield on the Chilean side is Chacalluta, a joint civil-military field situated just south of the border and 2½ kilometers inland from the Pacific. It has an asphalt runway slightly over 2,165 meters (7,100 feet) long. Linea Aerea Nacional, Lloyd, Aerco Boliviano, Alfa, and Lasa all use this field. Chacalluta has taken the place of El Buitre as the main civil airfield for Arica and handles a considerable amount of passenger service to and from Santiago. El Buitre, a smaller field 3 kilometers southeast of Arica, is now used by the local aeroclub. (C)

The second best Chilean airfield in the region is Cavancha located in the southeast environs of Iquique. It has an asphalt runway 1,720 meters (5,643 feet) long and is jointly used by the Chilean Air Force, Linea Aerea Nacional, and the local aeroclub. The field is not fully adequate even for the DC-6's that serve it and has probably reached the limits of its growth potential. Los Condores, a Chilean Air Force training field, is also located a short distance southeast of Iquique. Other minor airfields with runways longer than 600 meters (2,000 feet) include: Pisagua, Colchanes, Mauque, and Zapahuira. A widened portion of the highway leading east-northeast from Huara (northeast of Iquique) is paved and serves as an airstrip. Recently completed General Diego Aracena Airport (also known as Chucumata) lies outside the study area 39 kilometers south of Iquique. It has an asphalt runway more than 2,560 meters (8,400 feet) long. The field, built as an international airport, is currently being used as a fighter base by the Chilean Air Force. (C)

## Ports

Seaports play a key role in the economic life of the border region and would serve as significant, although vulnerable, supply points in case of war. Ports in the study area include Matarani, Mollendo, and Ilo in Peru, and Arica, Pisagua, and Iquique in Chile. (For information on POL storage at selected ports see Annex B.)

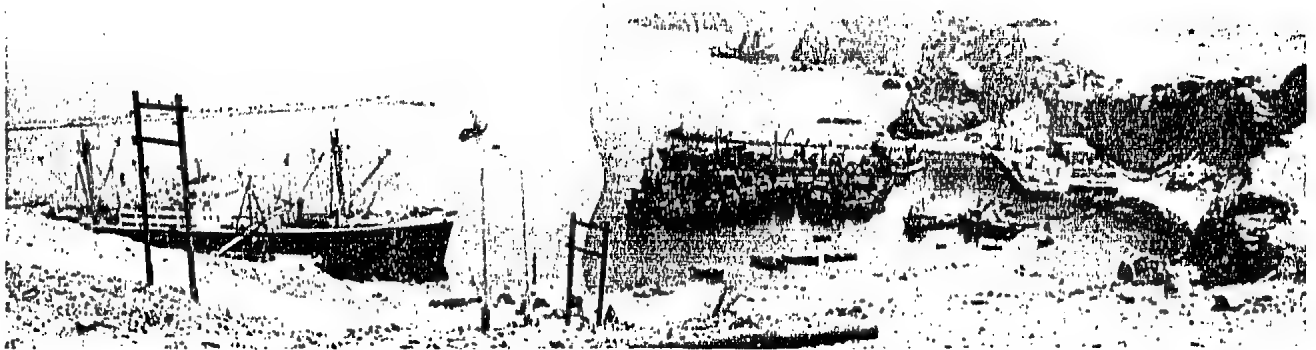


Open storage area at the port of Matarani; Soviet built trucks at left. (C)

Of the Peruvian ports, Matarani is by far the most important; it has almost completely supplanted nearby Mollendo as a port. The main quay at Matarani is about 550 meters long, has alongside depths of about 9 meters and can accommodate three large merchant ships simultaneously. In addition to its main quay the port has a small cabotage quay and a fish offloading pier, all served by rail. Mobile cranes of 5- to 10-ton capacity are available and there are five large warehouses as well as an extensive area for uncovered storage. A conveyor assembly moves small cargo to the top of a steep cliff immediately behind the port area. The harbor is well sheltered but somewhat difficult to enter because the coast is rocky and the approach is not a straight line. Ships with drafts greater than 9 meters cannot enter.

In addition to serving southern Peru, Matarani handles a growing portion of Bolivia's imports and exports. Tax-free movement of cargo to and from Bolivia is authorized by a transit agreement between the two governments. The port is the marine terminus for the Titicaca-Matarani Train-Ferry Bulk Minerals System, which ships Bolivian ore across Lake Titicaca and then down to Matarani by rail.

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The port of Matarani, Peru. Large cargo ship at the main dock; smaller boats clustered near fishing wharf. Note the steep rocky cliffs and absence of vegetation. (two photos) (UNC)

Mollendo was once an important lighter port but has practically ceased to function as such since the development of Matarani. Its harbor is a roadstead slightly protected to the northeast by a small peninsula. Bunkering takes place at a special oil berth located a kilometer south of Mollendo, where submarine pipelines extend offshore from a tank farm.

Ilo, midway between Mollendo and the Chilean border, is the principal fishing port on the south coast of Peru and the shipping point for copper ore from the Toquepala mine. It also serves as an export center for the agricultural products of the Moquegua valley. The port has two principal piers. One, with two berths for oceangoing ships of 20,000 tons, is served by rail and used for mineral export. The other pier is served only by road and is used for general cargo and fishmeal. A smaller quay serves small craft, lighters, and fishing boats. A fixed 25-ton crane and several mobile cranes of smaller capacity are available for loading lighters.

Arica, situated at the foot of a rocky headland only 16 kilometers from the border, is the principal general cargo port for northern Chile. It also handles a substantial amount of Bolivian and some Peruvian foreign trade. Arica is a free port for Bolivia, and plans have been developed to establish an international zone that would give Peru and Brazil port facilities and land for the construction of industrial plants. Shipments from the port include tin ore from Bolivia and cotton, salt, copper, and sulphur from Chile. The major imports are general cargo, food-

stuffs, and petroleum products, mostly destined for Bolivia. The harbor consists of a sheltered coastal breakwater-mole in an open roadstead; it is exposed to frequent southwest swells, especially in June, July, and August. The port can accommodate alongside 5 large and 1 standard ocean-type cargo vessels, 1 large and 1 standard ocean-type tanker, and 11 lighters. Fixed moorings are available for three large ocean-type cargo vessels outside the harbor, and large numbers of all sizes of ships can anchor in the roadstead in depths of 11 to 18 meters. (S)



Conveyor rising to bluffs behind port of Matarani, Peru. (C)

About 125 kilometers south of Arica is the former nitrate exporting center of Pisagua. Today nitrates no longer pass through Pisagua and it is little more than a minor fishing port. The rail line that once connected the port with Iquique has been abandoned. Pisagua is notable as the site of an important battle in the War of the Pacific. Chilean troops landed



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and completely routed a force of Bolivians and Peruvians from strong positions on the bluffs behind the town.

Iquique, at the southern extremity of the border region, is an important nitrate-exporting and fish-processing center. Shipments include bulk and bagged nitrates and smaller amounts of iodine, salt, fish, and fishmeal. The harbor, with depths from 5½ to 31 meters, is situated in a bay that is open to the north and sheltered by an island and causeway. Heavy northern swells limit berthing along the breakwater-mole. Alongside berths are available for 1 large, 1 standard, and 1 small ocean-type cargo vessel; 2 standard coaster-type vessels, 2 standard ocean-type tankers, and 51 lighters. Fixed mooring for ocean-type vessels is available in the bay and anchorage for two standard ocean-type cargo vessels inside the harbor. (S)



The deep water harbor at Arica, Chile. (C)

Bolivian press reports in December 1974, the YPBF was planning to install two new tanks in Arica, each with a 200,000-barrel capacity.

The pipeline, about 10 kilometers from the border, would be vulnerable to interdiction by Peruvian forces. An elaborate area defense plan reportedly has been formulated that involves diverting oil from the pipeline into the Rio Lluta and setting it afire, but the feasibility of this proposal appears dubious. (C)

## POPULATION AND SETTLEMENTS

The border region is sparsely populated. Most settlements are limited to the immediate vicinity of the coast or to sites in highland basins and stream valleys where irrigation agriculture is practicable. Broad tracts of barren terrain are completely uninhabited.



### Pipeline

The Trans Andean Pipeline, a 972-kilometer crude oil pipeline owned by the Bolivian State Petroleum Agency (YPBF), extends from Santa Cruz, Bolivia, via Sicasica, Bolivia, (both outside the study area) to the marine terminal at Arica. It is the highest pipeline in the Western Hemisphere. The 150-kilometer section in Chile parallels the Arica-La Paz railroad. It is 8 inches in diameter and reaches its greatest altitude at more than 4,400 meters near Volcan Tacora. For some years the line, which has a throughput capacity of 50,000 barrels of crude oil a day, has operated at only 25,000 barrels a day because of the limited storage capacity, approximately 300,000 barrels, available at Arica. According to

In 1961 the population density of Tacna, Peru's southernmost department, was estimated at 5½ persons per square kilometer. Slightly more than half the population was classified as urban and the remainder rural. The most recent official estimate, 1969, placed the total population of the department, at 87,400 and the population density at almost 7 persons per square kilometer. Today, the total population is probably considerably larger, but most of the increase is thought to have taken place in the towns; the rural areas remain sparsely inhabited.

On the Chilean side of the border, the department of Arica had a population of 96,105 and a population density of about 6 persons per square kilometer, according to the 1970 Chilean census. The ever-

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whelming majority, more than 92,000, lived in the Comuna of Arica, which includes the city of the same name. As in Peru, most recent increases in

population have probably taken place in the larger towns (especially in Arica, now estimated to have 150,000 inhabitants), and the countryside is still mostly deserted.

The following places, arranged in order of their distances from the Chile-Peru border, are worthy of note.

	Population (approximate)	Remarks
Matarani	<2,000	Best Peruvian port south of Callao; about 230 kilometers from Chilean border
Arequipa	225,000	Third largest city in Peru
Mollendo	14,000	Oil bunkering. Houses Matarani port workers
Moquegua	10,000	Administrative and market center of agricultural area
Ilo	2,000	Mineral export, fishing port
Toquepala	<2,000	Large open pit copper mine nearby
Tuena	45,000	Excellent water system, hospital. Growing rapidly; 1961 population 10,114. Within 35 kilometers of Chilean border
PERU		
Border		
CHILE		
Arica	150,000	Port. Terminus of two railroads and of pipeline to Bolivia. About 17 kilometers from Peruvian border
Pisagua	*	Fishing port; prison; former nitrate center
Iquique	65,000	Nitrate, fishing port; capital of Tarapaca Province
Mamina	<2,000	Hot springs resort; nearby copper deposits to be exploited; about 220 kilometers from Peruvian border

\*Population June 1974: 100 civilians (mostly fishermen), a platoon of soldiers, and approximately 1,000 detainees.



Pisagua, Chile. Political prisoners arrested following coup against Allende. Note the steep bluffs in the background. (OFO)

## ECONOMIC ACTIVITIES

### Mining

The most important mining activity in the border region is the Southern Peru Copper Corporation's huge open pit operation at Toquepala, Peru. The mine has consistently produced more than half of Peru's annual output of copper since it opened in 1960. Of the original reserve of 410 million tons, about 250 million remain, enough for 18 more years. The mine, at 3,400 meters above sea level, is 1,600 to 2,000 meters across. Nine or ten levels are mined at a time; the lower benches are served directly by rail, the higher benches by truck.

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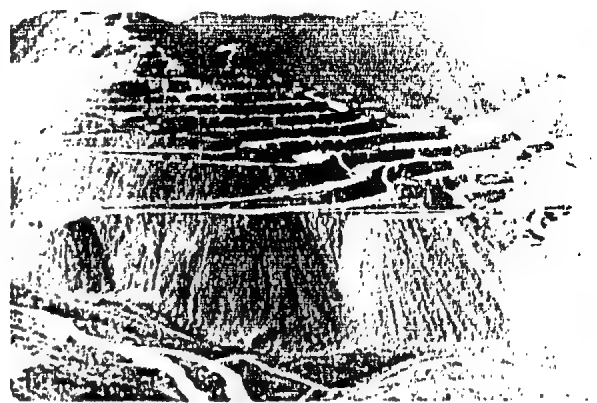
Arequipa, Peru, largest populated place in the study area. Snow covered volcano rises in background. (OUO)

The concentrator, located 6 kilometers from the mine, turns out 1,600 tons per day of copper concentrate, containing 28 percent copper. One train each day covers the 187-kilometer, 6½-hour route from the concentrator to the smelter on the coast at Fundicion, near Ilo. Water for the concentrator and the mine comes by pipeline from Laguna de Suches, 60 kilometers northeast of Toquepala; the concentrator takes a ton of water for every ton of ore. A molybdenum plant at Toquepala recovers about 1,300 tons of molybdenum each year.

Less than 25 kilometers north of Toquepala at Cuajone, the Southern Peru Copper Corporation is starting up another large mine, the biggest and most complex mining operation ever carried out in Peru. The Cuajone pit, already an enormous elongated

bowl more than 1,000 meters (a mile) across, is planned to produce initially 170,000 tons of copper per year. Cuajone's reserves are estimated at 470 million tons, containing 1 percent copper.

In Chile, rich sulfur deposits are mined from the flanks of Volcan Tacora near the Peruvian border, about 80 kilometers to the south at Chapiquina and at a number of other points in the high volcanic range. The importance once attached to the Volcan Tacora sulfur beds is reflected in the alignment of the Chile-Peru boundary; most of the boundary is defined as a line ten kilometers north of the Arica-La Paz railroad, but the northern segment was deflected to leave the volcano in Chilean territory. The high altitude of the mines (over 4,500 meters) and the difficulty of extracting sulfur from the volcanic ore have discouraged full exploitation of the deposits, but rising demand will lead to greater effort in the future. Volcan Tacora alone is expected to produce 30,000 tons of sulfur in 1976, and 150,000 tons annually in 1980-82.

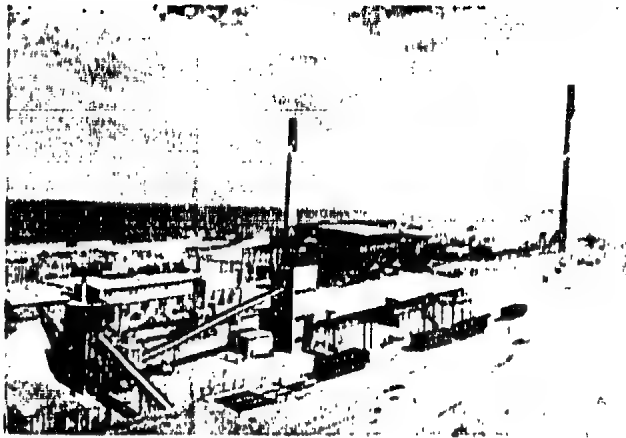


The Toquepala copper mine, Peru. (OUO)

Nitrates, once Chile's most prized mineral resource and a principal cause of the War of the Pacific, are making something of a comeback following a long slump brought on by the development of chemical substitutes. The bulk of the deposits are located south of the study area, but considerable amounts are found in the northern part of Iquique Department, along the eastern slopes of the coastal range.



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Copper smelter near Ilo, Peru. (OUO)

Other minerals mined to some extent in the border region include borax, silver, and marble. The abundant iron ore deposits in the Pampa de Tamarugal in Chile are unexploited.

#### Agriculture

The dry border region has little arable land. Above 2,500 meters, where moisture is adequate for hardy bunch grass, flocks of alpacas and llamas are grazed. Below that altitude agriculture is limited to a few scattered oases and stream valleys with sufficient water for irrigation. In Peru, land is cultivated around Arequipa and Tacna; in the Moquegua Valley; and along the lower valleys of the Rio Vitor, Rio de Ilo, Rio Locumba, and Rio Sama. In Chile, cultivation takes place near the coast in the valleys of the Lluta, Azapa, Vitor, and Camarones Rivers, and farther inland in the Quebrada de Tarapaca and around Mamina.



Farmland and cattle on the outskirts of Arequipa, Peru. (C)

Crops produced in the region include various grains, fruits, vegetables, nuts, fibers, and fodder plants. For example, most of the Moquegua Valley below the town of Moquegua is devoted to grapes, and the upper valley grows wheat, maize, potatoes, cotton, avocados, and other fruits. Cattle, sheep, and goats are raised in the few places where pasturage is available. Arequipa has a significant number of dairy cattle. Overall, the agricultural production of the border region is insufficient to meet the needs of the local population, and substantial imports of food are required.

A number of large-scale irrigation projects are under way within the region. One of the largest, the Majes-Siguas in Peru, was initiated in 1971 with an estimated completion time of 8 years. The plan calls for irrigation of some 60,000 hectares of potentially fertile land midway between Arequipa and Camana. Water for the project will flow by way of stream valleys, tunnels, and canals from two large reservoirs located 160 kilometers inland at elevations over 4,000 meters. In Chile, irrigation projects have aimed at expanding cultivation in the Lluta and Azapa Valleys, and renewed interest has been expressed in longstanding plans for forestation in the Pampa de Tamarugal. Irrigation and drinking water are piped to the Arica area from a reservoir at Chapiquina, about 80 kilometers inland.



Cultivated fields northeast of Tacna, Peru. (C)

#### Fishing

The cool water of the Humboldt Current, which moves northward off the coast of Peru and Chile, abounds in commercially valuable fish. The most important of the various species is the anchovy, which is exploited on a large scale for the production

of fishmeal and fish oil, Peru is the first-ranking producer of fishmeal in the world, and although the bulk of the catch is made to the north of the study area, the fishing industry plays a significant role in the economic life of the border region in both Peru and Chile. Large fleets of fishing boats operate out of Matarani, Ilo, Arica, and Iquique; and numerous fishmeal plants, canneries, cold storage installations, and other facilities directly or indirectly serving the fishing industry are located at Islay, Ilo, Mollendo, Arequipa, Tacna, Arica, and Iquique. A whaling station is situated about 6 kilometers south of Iquique.



Barren hill slopes and cultivated plain northwest of Mamina, Chile. (C)

#### Electric Power

Electric power for the region is produced by diesel and thermal plants along the coast and by hydroelectric plants inland. The principal facilities are listed below.

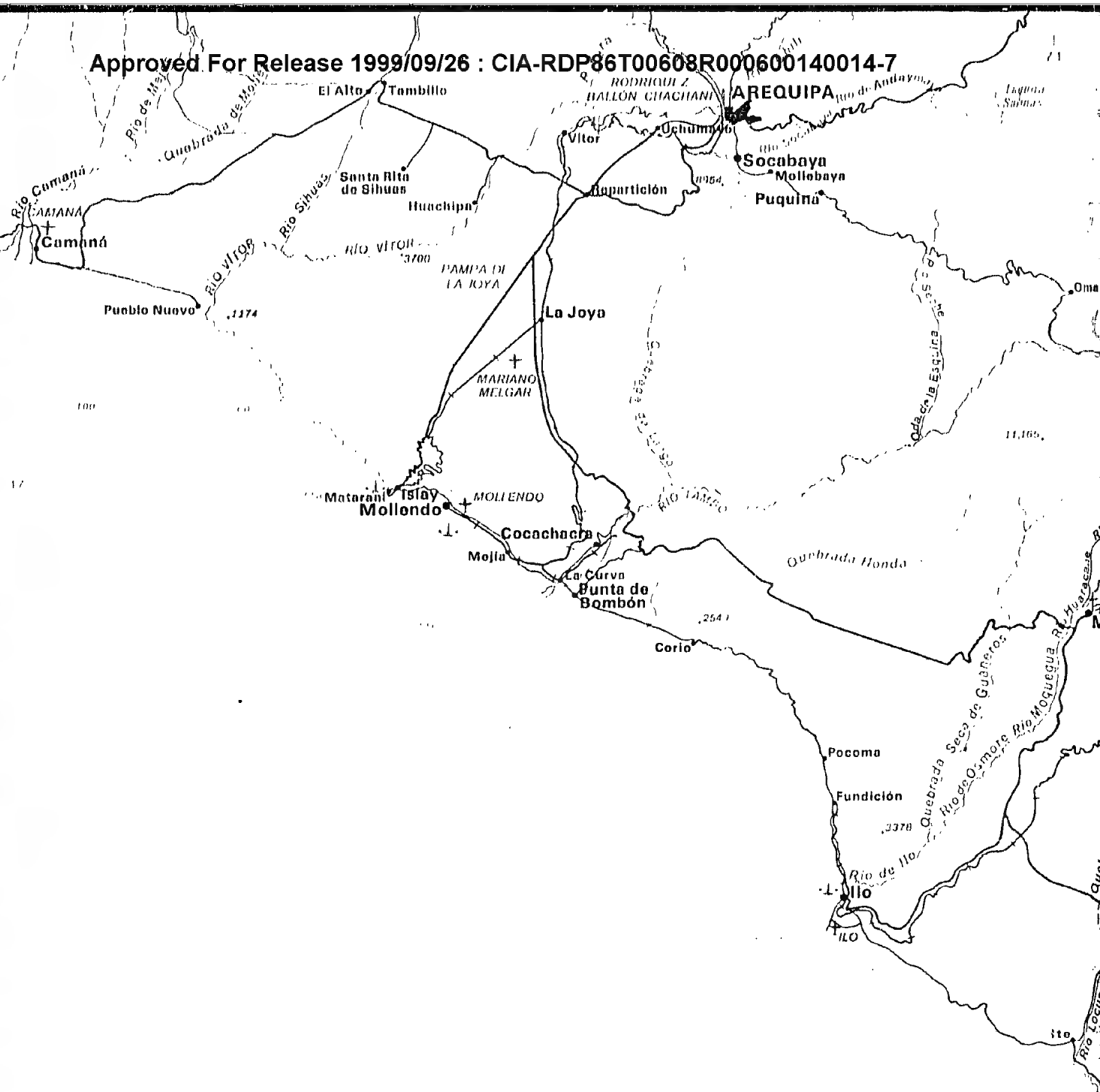
The plants are located at or near the places for which they are named; Aricota I and II are on the Rio Curibaya just below Laguna Aricota (about 50 miles north of Tacna).

Power for the mining complex at Toquepala is supplied by the Southern Peru Copper Corporation's (SPCC) thermal power plant in Ilo. When the government-owned Mineroperu refinery at Ilo is completed, an exchange will be made so that SPCC will provide power for the new refinery, and the government's electric power enterprise, Electroperu, will supply Toquepala from its hydroelectric facilities at Aricota.

Additional power plants scheduled for completion during the next few years in Arequipa, in Mollendo, and as part of the Majes-Siguas irrigation project southwest of Arequipa will substantially increase the electric generating capacity of Southern Peru. In northern Chile the feasibility of exploiting geothermal energy is being explored actively, and two sites in the departments of Arica and Iquique have already been selected as possible locations for power plants.

(C)	Name	Type	Capacity
Peru	Arequipa Chacabamb	Hydro	27,000 kW
	Ilo	Thermal	97,800 kW
	Aricota I	Hydro	23,500 kW
	Aricota II	Hydro	11,800 kW
	Chile		
Chile	Arica	Diesel	7,724 kW
	Chapichuma	Hydro	30,600 kW
	Iquique	Diesel	7,124 kW

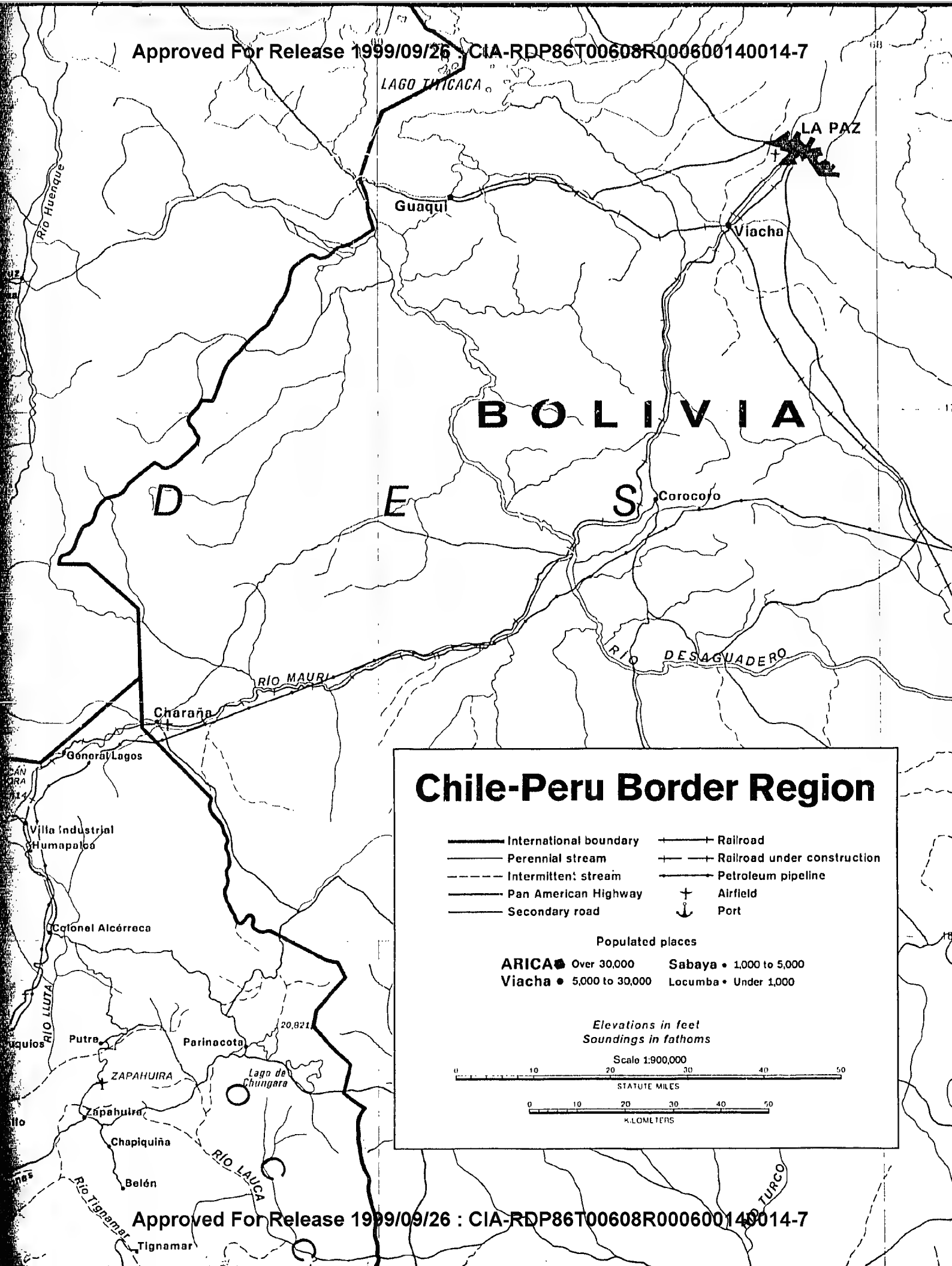
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SOUTH PACIFIC OCEAN







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## ANNEX B

### POL STORAGE AT SELECTED PORTS (C)

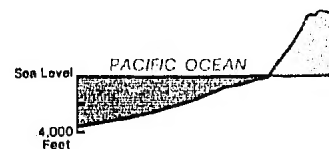
Mollendo	<p>Six tanks located at 16°59'45"S 72°00'20"W with, total capacity of 213,000 barrels:</p> <ul style="list-style-type: none"> <li>50,000 bbl. mogas</li> <li>37,000 bbl. kerosene</li> <li>59,000 bbl. diesel oil</li> <li>67,000 bbl. fuel oil</li> </ul>
Ilo	<p>Three tanks located on coast north of town at 17°29'35"S 71°21'40"W with total capacity of 242,000 barrels of fuel oil.</p> <p>Nine tanks with total capacity of 87,000 barrels:</p> <ul style="list-style-type: none"> <li>28,000 bbl. mogas</li> <li>15,000 bbl. kerosene</li> <li>40,000 bbl. fuel oil</li> <li>4,000 bbl. other</li> </ul>
Iquique	<p>Eleven tanks located on coast north of city at 20°11'55"S 70°08'40"W with total capacity of 253,650 barrels:</p> <ul style="list-style-type: none"> <li>204,000 bbl. fuel oil</li> <li>33,700 bbl. diesel oil</li> <li>10,500 bbl. mogas</li> <li>2,700 bbl. avgas</li> <li>2,750 bbl. kerosene</li> </ul>
Arica	<p>Six tanks with total capacity of 300,000 barrels of crude oil located in port area at terminal of pipeline from Bolivian oilfields.</p> <p>Four tanks located on coast north of city at 18°28'09"S 70°19'29"W with total capacity of 43,800 barrels:</p> <ul style="list-style-type: none"> <li>15,000 bbl. avgas 100/130</li> <li>10,000 bbl. turbo jet fuel</li> <li>12,000 bbl. mogas</li> <li>6,800 bbl. kerosene</li> </ul>

19



**Generalized Profile of**  
**Approximately 20**  
 Horizontal scale 1  
 Vertical exaggeration 7

20





# **Generalized Profile of Northern Chile** Approximately 20°S Latitude

Horizontal scale 1:1,000,000  
Vertical exaggeration 7:1 approximately

